

PATENT COOPERATION TREATY

PCT

REC'D 03 MAY 1999

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|---|---|--|
| Applicant's or agent's file reference P53206WO | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/GB98/00866 | International filing date (day/month/year) 03/04/1998 | Priority date (day/month/year) 03/04/1997 |
| International Patent Classification (IPC) or national classification and IPC G08C15/02 | | |
| Applicant SUN ELECTRIC UK LIMITED et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 11 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

| | |
|---|--|
| Date of submission of the demand 03/11/1998 | Date of completion of this report 29.04.99 |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0 Tx: 523656 epmu d Fax: (+49-89) 2399-4465 | Authorized officer Wright, J Telephone No. (+49-89) 2399 2705  |

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB98/00866

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

| | | | |
|--------------|---------------------|------------|---------------------------|
| 1-3,5,6,8-14 | as originally filed | | |
| 4,4a,7 | as received on | 17/04/1999 | with letter of 14/04/1999 |

Claims, No.:

| | | | |
|------|----------------|------------|---------------------------|
| 1-25 | as received on | 17/04/1999 | with letter of 14/04/1999 |
|------|----------------|------------|---------------------------|

Drawings, sheets:

| | |
|---------|---------------------|
| 1/4-4/4 | as originally filed |
|---------|---------------------|

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
☒ paid additional fees.
☐ paid additional fees under protest.

**INTERNATIONAL PRELIMINARY
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☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

☐ complied with.

☒ not complied with for the following reasons:

see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☒ all parts.

☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|-------------------|
| Novelty (N) | Yes: | Claims | 1-25 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 2,4,5,14,16,17 |
| | No: | Claims | 1,3,6-13,15,18-25 |
| Industrial applicability (IA) | Yes: | Claims | 1-25 |
| | No: | Claims | |

2. Citations and explanations

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB98/00866

1. The following document(s) will be referred to in this preliminary examination report;

D1 US-A-4 738 133 [Breckel et al]
D2 US-A-5 509 013 [Adachi et al]
D3 DE-A-4 106 572 [Fraunhofer Gesellschaft München]

The subject-matter of document D1 is considered to represent the prior art the closest to that of the present application, inventions 1 and 2.

2. In the following discussion, the patentability of the claims will be examined with regard to the requirements of the PCT. In particular, the claims will be examined for novelty, as defined in Art. 33(2) PCT, and for inventive step, as defined in Art. 33(3) PCT. In addition other aspects, such as clarity requirements of Art. 6 PCT, may be discussed as appropriate.
- 2.1 The application lacks unity within the meaning of Rule 13 PCT, since the claims presently on file claim the following separate inventions or groups of inventions not so linked as to form a single general inventive concept. The application therefore does not comply with the requirements of Art. 3 (4)iii PCT. The application comprises the following separate inventions:

Invention 1. Claims 1-23

Invention 1 relates to **multiplex data transmission** via a wireless with different rates in each channel.

Invention 2. Claims 24-25

Invention 2 relates to a method and apparatus for **vibrational analysis** in a three dimensional space.

Since the applicant has **paid additional fees** under Art. 34 (3) a, **report on the complete application** will be made by the examiner.

For information only, the applicant may chose to prosecute the application on one

of the above inventions in the national / regional phase of the application.

2.2 Claim 1

The subject matter of claim 1 of the application is not allowable because it lacks an inventive step, Art. 33(3) PCT, the reasons being as follows:

Document D1 is considered to represent the closest prior art to the subject matter of claim 1 of the application. D1 discloses sensors (1,2,3) which are connected to a central control (5,6).

The examiner is of the opinion that it is a common and obvious problem in such a sensor/control arrangement that some sensors require a higher data carrying capacity than others. The problem is for instance known from the document D2, see for instance col. 1, lines 16-18.

The examiner notes that although D2 specifically relates to channels having varying "transmission speeds" this means different "data carrying capacity", since data carrying capacity only has meaning in terms of a given time period during which data can be sent. Nothing in claim 1 of the application refers to channel band-width or the like.

The person skilled in the art, wishing to solve this problem would use the solution proposed in document D2. D2 discloses the multiplex control system for such a sensor/control arrangement but does not explicitly mention the control/sensors themselves.

D2 discloses that in a plurality of multiplexed channels (these are considered to be sub-channels of a single channel), some channels with higher data rates are assigned correspondingly increased data transmission load, see abstract, col. 6, lines 28-32 (gives a definition of a "cell" and col. 7, lines 14-24 (which defines how data is asymmetrically divided in accordance with the data carrying capacity of the sub-channels) and col. 7, lines 33-37 (dynamic changing of channel data transmission

capability). The multiplexing of data is therefore asymmetrically arranged in accordance with the channel data carrying capacity.

The person skilled in the art, incorporating the teaching of D2 into the method/apparatus of D1 would therefore arrive at the subject matter of claim 1 of the application without having made an inventive step.

The above argument hinges on the question of whether the person skilled in the art **would combine** D1 and D2. The examiner notes that D2 does not address the specific environment of data collection from sensors, rather it addresses the more general problem of transmitting by what ever means data from one remote location to another by means of transmission channels of some kind. The examiner furthermore notes that the solution offered to the above problem in D2 which is the same as in the application, has no technical features which relate to the kind of data generated, the means of transmission or to the source of data. The examiner furthermore notes that nearly all data is actually sourced from some kind of sensor, be it a microphone in a telephone, a pressure sensor or a light responsive sensor in a FAX machine.

The examiner concludes that the problem posed in D2 is very general to the field of data transmission and the person skilled in the art would therefore be very aware of this problem when dealing with any data transmission. The features of claim 1 of the application (known in themselves from D1) are merely contextual and do not add technical features which would be considered to involve an inventive step.

Claim 1 is therefore not allowable under Art. 33(3) PCT.

The examiner notes that claim 1 would appear to be clear and therefore to satisfy the requirements of Art. 6 PCT.

2.3 Claims 2 to 5

The examiner notes that claims 2 to 5 relate to the way in which the channels are divided.

From D2, col. 1, lines 54-64 it would appear that the channel division is on a time division basis. The examiner is now of the provisional opinion that claim 3 of the application lacks inventive step, but that the division in accordance with claim 2 could be considered as being both new and involving an inventive step since there is no indication in the prior art to use frequency division.

The examiner is of the provisional opinion that the subject matter of claims 5 could likewise be considered to involve an inventive step, since packet switching is also not known from the available prior art D1 or D2.

The examiner considers that the subject matter of claim 4 **could** contain subject matter which involved an inventive step, but that it is so unclear to the examiner what is being claimed that the present claim does not satisfy the requirements of Art. 6 PCT.

In particular the examiner is not aware of the term "interdigitated non-chopping data-allocation basis" with regard to channel division /multiplexing etc. Furthermore the criteria that a "degree" of data element transmission time overlap is permitted is indefinite and vague.

The applicant is also informed for information only that the examiner is of the provisional opinion that any independent claim (in the regional or national phase of the application) based on the division mechanism, e.g. frequency division, would not be acceptable if based on alternatives, i.e. only one mechanism could be considered as constituting one unifying inventive concept, since the more general concept of the application is already known from D2.

2.4 Claims 6-12

Although the subject matter of the claims 6-12 is not per se known from a combination of D1 and D2, these relate largely to the area of application of the sensor/control arrangement. The technology of the application, for instance vibration sensing, is considered to be independent of the arrangements for data transmission. As such these

claims represent various juxtapositions of features which would appear to be known in themselves, as such the examiner considers them not to involve an inventive step, Art. 33(3) PCT.

It is furthermore noted that claim 10 lacks clarity, Art. 6 PCT. The reason being that a reference in parenthesis to "NVH" would appear not to be a reference to the drawings but an attempt to define a short form for "noise vibration harshness".

The term "NVH" is then used without brackets in claim 22 and with brackets in claim 21. In the opinion of the examiner the brackets with the term "NVH" should not be used in any of the claims.

2.5 Claim 13

Claim 13 relates to an apparatus for wireless transmission of data using divided channels in which an asymmetric data rate in respective (so called sub-) channels is effected in accordance with **the different data rate requirements of local sensors**.

From the document D2, col. 1, lines 10-18 it is known to match data rate requirements with a particular channel transmission speed. The person skilled in the art would apply this principle to the specific example of data passing from a sensor without making an inventive step. The person skilled in the art would therefore incorporate this into the sensor / test arrangement of D1, see D1, fig. 1 and 2. In so doing, the person skilled in the art would assign channels in accordance with the different data rate requirements of respective sensors and so arrive exactly at the subject matter of claim 13 of the application without having made an inventive step.

The subject matter of claim 13 is therefore obvious in the light of the available prior art D1 and D2, and as such not allowable under Art. 33(3) PCT.

2.5 Claims 14-17

Claims 14 to 17 correspond to the method claims 2-5. For the reasons given above the examiner considers that claim 15 lacks an inventive step, time division being known from D2. Claims 14 and 17 could be considered to involve an inventive step and claim 16 could contain patentable subject matter but is so unclear, Art. 6 PCT, that it is not possible to be more specific as to any inventive quality of the claim.

2.6 Claims 18-23

Claims 18-23 comprise subject matter which is of a routine nature. The examiner is therefore of the provisional opinion that the person skilled in the art would arrive at the subject matter of claims 14-23 as a matter of normal design procedure, starting from the obvious combination of D1 and D2. The subject matter of claims 14 to 23 is therefore not allowable under Art. 33(3) PCT.

2.6 Claim 24

Claims 24 and 25 relate to sensing in three dimensions. The closest prior art to claims 24 and 25 would appear to be D3. D3 also relates to vibration sensing in three dimensions.

Claim 24 is a method claim, D3 discloses:

- a. a method for vibration analysis of a machine or other article (see abstract) comprising;
 - a. providing a vibration sensor (1)
 - b. causing the sensor to sense vibrations (see abstract)
 - c. analysing signals produced by said sensor (15, see col. 5, lines 60-62)
 - d. providing the sensor with 3d location sensing means (D3, col. 6, lines 25-50)
 - e. causing a single vibration sensor to monitor 3 dimensions, (see fig. 2 and col. 4,

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lines 64-65 of D3) and using the coordinate measuring system to measure the coordinates at these points (D3, col. 6, lines 25-50)

The subject matter of D3 differs from that of the application claim 24 only in that the features:

f. "identifying the location of a source of vibration accordingly" is not explicitly disclosed in D3;

and the feature of mechanical contact is not disclosed in D3, D3 operating with light beams.

However, in col. 1, lines 15-25 of D3, it is disclosed that it is necessary to understand as accurately as possible the vibration characteristics of a machine etc.

In the opinion of the examiner, to identify the source of a vibration is an obvious desire of the person skilled in the art who wishes to understand "as accurately as possible" the vibration characteristics of a machine.

In addition the examiner is of the opinion that the choice of sensor, being light beam sensor or a mechanical sensor is merely one of design choice which the person skilled in the art would make without having made an inventive step.

Since the other features of claim 24 are not different from those of D3, the examiner is of the opinion that claim 24 of the application lacks an inventive step and as such is not allowable under Art. 33(3) PCT.

It is furthermore noted that claim 24 is not allowable under Art. 6 PCT since it lacks clarity. In particular the "said three locations" (line 26) are not actually previously referred to in the claim. It would appear that the author of the claim confuses "three-dimensions" with three locations, in the opinion of the examiner a single point can be defined in "three-dimensions" and this in no way implies there to be three points.

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2.7 Claim 25

Claim 25 is an apparatus claim which claims (in terms of an apparatus) the features a. to d. corresponding to those features a. to d. in claim 24.

As discussed above in part 2.6 of this opinion, these features are all known from the document D3, except for the feature of mechanical sensing. As discussed above the examiner is of the opinion that this combination of features lacks an inventive step as such claim 25 does not fulfil the requirements of Art. 33(3) PCT.

times) and to individual channels within the groups (at transmission times) so as to increase throughput and reduce packet loss. For bursty traffic, the use of channel groups reduces the packet loss by several orders of magnitude.

5 EP 0 515 728A2 relates to a wireless indoor relay system. AU-A-18143/88 relates to a wireless data transmission link and notably a protocol for establishing a duplex link between first and second data link devices.

Other known references include:

10 GB 2295070

EP 0483549

EP 0268492

US 5509013

US 5448759

15 US 5363370

US 4,738,133 discloses a system for wireless transmission of multiplexed data from a plurality of transducers.

20 US 5,509,013 discloses a multiplexer control system for multiplexing the data from a plurality of input channels having different transmission speeds.

25 DE 4106572 discloses a system for contact-free measurement of object oscillations by directing laser light onto the object and detecting reflected light at plural spaced sensing heads so as to locate the point on the object from which the reflections are emanating.

30 According to the invention there is provided a method and apparatus for wireless transmission of data through a communications channel between at least two local data sensors with optional primary data processing and a data processing function, as defined in the accompanying claims.

35 In a described embodiment, there is provided a method and apparatus in which the step of multiplexing division of the communications channel is effected asymmetrically, whereby the data carrying capacities of the sub-channels are unequal. Likewise in the embodiment, the data rates required for data transmission from the local sensors

4a

differs substantially between the at least two sensors. Likewise also in the embodiment, the step of allocating data from the local data sensors to the data transmission sub-channels is effected in accordance with the data-carrying capacities of these sub-channels. In this way there is achieved within a

5

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vibrational analysis of machines and other articles and products and systems. In accordance with this aspect of the invention a vibration sensor, for example an NVH (noise vibration harshness) sensor is mechanically coupled to the machine or other article to three-dimensionally locate a source of vibration in a machine or system. Such a sensor may be just one of the local sensors in the wireless transmission system of the other embodiments, or it may be provided with its own cable or other transmission channel for its vibration signals.

In order to three-dimensionally locate a source of vibration, the vibration signals are monitored at three or more positionally-defined locations of the sensor. In the preferred embodiment the sensor is provided with its own three-dimensional location or co-ordinate-defining system (utilising spaced infra-red sensors), so that the sensor's location at any given time is readily defined. Alternatively, the sensor may be caused to sense at three known locations, or three sensors may be provided, one each at three such locations.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig 1 shows a functionality block diagram for a high speed RF data link, including both the frequency multiplexing system (of Figs 2 and 3) and the time-division multiplexing system (of Figs 4 and 5 hereof);

Figs 2 and 3 show block diagrams of the transmitter and receiver functions of the system of Fig 1 as it applies to a frequency multiplexing system;

Figs 4 and 5 show block diagrams of the transmitter and receiver functions of the system of Fig 1 as they apply to a time-division multiplexing system; and

CLAIMS

1 A method of wireless transmission of data in digital
and/or analogue format through a communications channel
5 (72) from at least two local data sensors (14, 16) to a
data processing means (24), said method comprising the
step of division of said channel into sub-channels and
transmitting said data from said data sensors respectively
through said sub-channels accordingly;

10 characterised by

a) said step of division of said communications
channel being effected asymmetrically whereby the data
carrying capacities of said sub-channels are unequal; and

15 b) the data rate required for data transmission from
said local sensors differing substantially between said at
least two sensors; and

c) allocating data from said local data sensors to
respective ones or groups of said sub-channels [being
effected] in accordance with the data carrying capacities
20 of said sub-channels.

2 A method according to claim 1 characterised by said
step of division being effected on a frequency basis.

25 3 A method according to claim 1 characterised by said
step of division being effected on a time-division basis.

30 4 A method according to any one of claims 1 to 3
characterised by said step of division being adapted to
effect said division on an interdigitated non-chopping
data-allocation basis in which a degree of data element
transmission time overlap between channels is permitted.

35 5 A method according to claim 1 characterised by said
step of division being effected by packet-switching of data
from said local data sensors, and interleaving said data
packet with an unsymmetrical packet distribution.

6 A method according to any one of claims 1 to 5
characterised by said data processing means comprising a
host PC (24) having a series of virtual serial ports, and
5 said method comprising allocating each of said sub-channels
to a corresponding one of said virtual serial ports.

7 A method according to any one of claims 1 to 6
characterised by said local sensors comprising automotive
10 diagnostic and/or servicing sensors and said wireless
transmission of data being effected at radio frequencies.

8 A method according to any one of claims 1 to 7
characterised by at least one of said local sensors (14)
15 also providing a primary data-processing function.

9 A method according to any one of claims 1 to 8
characterised by said local sensors comprising vibration
sensor means (104) adapted to sense machine vibration, and
20 said method comprising transmitting said data therefrom.

10 A method according to claim 9 characterised by the
step of using as said sensors, sensors (104) adapted to
provide vibration data permitting noise vibration harshness
25 (NVH) analysis of the data.

11 A method according to claim 10 characterised by at
least three of said sensors being such NVH sensors, and the
method comprising employing said sensors at
30 three-dimensionally spaced locations to identify the
location or co-ordinates of a source of vibration.

12 A method according to claim 9 or claim 10
characterised by said vibration sensor means further
35 comprising three-dimensional location sensing means (106)
and the method comprising the step of using said sensor to
sense vibrations at three dimensionally-spaced locations in

sequence, and using said three-dimensional location sensing means to identify the location or co-ordinates of said three spaced locations so as to identify the location or co-ordinates of a source of vibration.

5

13 Apparatus for wireless transmission of data in digital and/or analogue format through a communications channel (12) from at least two local data sensors (14, 16) to a data processing means (24), the apparatus comprising a
10 multiplexer (62) adapted to effect division of said communications channel into sub-channels, and a transmitter (34) adapted to transmit said data through said sub-channels accordingly;

characterised by

15

a) said multiplexer being adapted to divide said communications channel asymmetrically whereby the data carrying capacities of said sub-channels are unequal; and

20

b) control means (40) adapted to allocate data from said local data sensors to respective ones or groups of said communications sub-channels in accordance with substantially different data rate requirements from said local sensors.

25

14 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect said multiplexing on a frequency basis.

30

15 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect said multiplexing on a time-division basis.

35

16 Apparatus according to any one of claims 13 to 15 characterised by said multiplexer being adapted to effect said multiplexing on an interdigitated non-chopping data-allocation basis in which a degree of data element transmission time-overlap between channels is permitted.

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17 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect packet-switching of data from said local sources and to interleave said data packets with an unsymmetrical packet distribution.

5

18 Apparatus according to any one of claims 13 to 17 characterised by said data processing function comprising a host PC (24) having a series of virtual serial ports, and said control means being adapted to allocate each of said sub-channels to a respective one of said virtual ports.

10

19 Apparatus according to any one of claims 13 to 18 characterised by at least one of said local sensors (14) being adapted to provide a primary data-processing function.

15

20 Apparatus according to claim 19 characterised by said local sensors comprising vibration sensor means (104) adapted to sense machine vibration whereby said apparatus can transmit said vibration data from said vibration sensing means.

20

21 Apparatus according to claim 20 characterised by said local data sensors comprising sensors adapted to provide vibration data permitting noise vibration harshness (NVH) data for analysis thereof.

25

22 Apparatus according to claim 21 characterised by said local data sensors comprising at least three or more such NVH sensors whereby said sensors can be located at three-dimensionally spaced locations to provide data enabling identification of the location or co-ordinates of the source of a vibration in a machine.

30

23 Apparatus according to claim 20 or claim 21 characterised by said vibration sensor means further comprising three-dimensional location sensing means (106)

35

whereby said vibration sensor means can sense vibrations at three-dimensionally-spaced locations in sequence and said three-dimensional location sensing means can identify the co-ordinates or locations of said three locations so as to enable identification of the location or co-ordinates of a source of vibration.

24 A method for vibration analysis of a machine or other article comprising:

- a) providing a vibration sensor (104);
- b) causing said sensor to sense vibrations;
- c) analysing signals produced by said sensor; characterised by
- d) providing said sensor with three-dimensional location sensing means (106);
- e) causing said vibration sensor to be mechanically coupled to the machine or other article to sense vibrations at three-dimensionally-spaced locations and using said three-dimensional location sensing means to determine the co-ordinates of said three locations; and
- f) identifying the location or co-ordinates of a source of vibration accordingly.

25 Apparatus for vibration analysis of a machine or other article comprising:

- a) a vibration sensor (104) adapted to sense vibrations at chosen locations; and
- b) analysis means (124) adapted to analyse signals produced by said sensor; characterised by
- c) said vibration sensor being adapted to be mechanically coupled to the machine or other article and further comprising three-dimensional location sensing means (106);
- d) whereby said single sensor can be caused to sense vibrations at three-dimensionally spaced locations at which said three-dimensional location sensing means can identify

the co-ordinate locations thereof whereby the corresponding co-ordinates of a source of vibration can be determined.

AMENDED SHEET

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

ARCHER, Ph.
URQUHART-DYKES & LORD
New Priestgate House
57 Priestgate
PETERBOROUGH, CAMBS PE1 1JX
GRANDE BRETAGNE

01 OCT 1999

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing
(day/month/year)

15.02.99

Applicant's or agent's file reference
P53206WO

REPLY DUE

within 2 month(s)
from the above date of mailing

International application no.
PCT/GB98/00866

International filing date (day/month/year)
03/04/1998

Priority date (day/month/year)
03/04/1997

International Patent Classification (IPC) or both national classification and IPC
G08C15/02

Applicant

SUN ELECTRIC UK LIMITED et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.

2. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and / or arguments, see Rule 66.4bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 03/08/1999

Name and mailing address of the international preliminary examining authority

European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax: (+49-89) 2399-4465

Authorized officer / Examiner
Wright, J

Formalities officer (incl. extension)
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2 COPIES:- *EP*

NUMBER:- *946*

CHECKED:- *1*

I. Basis of the opinion

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

Description, pages:

1-14 as originally filed

Claims, No.:

1-25 as originally filed

Drawings, sheets:

1/4-4/4 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation (Form PCT/IPEA/405) to restrict or pay additional fees, the applicant has:

- ☐ restricted the claims.
☒ paid additional fees.
☐ paid additional fees under protest.
☐ neither restricted nor paid additional fees.

2. This Authority found that the requirement of unity of invention is not complied with for the following reasons and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees:

3. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this opinion:

- ☒ all parts.
- ☐ the parts relating to claims Nos. .

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|--------|-----------------|
| Novelty (N) | Claims | 1-24 Yes, 25 No |
| Inventive step (IS) | Claims | 1-25 No |
| Industrial applicability (IA) | Claims | 1-25 Yes |

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

1. The following document(s) will be referred to in this written opinion; the numbering will be adhered to in the rest of the procedure:

D1 US-A-4 738 133 [Breckel et al]

D2 US-A-5 509 013 [Adachi et al]

D3 DE-A-4 106 572 [Fraunhofer Gesellschaft München]

The subject-matter of document D1 is considered to represent the prior art the closest to that of the present application, inventions 1 and 2.

2. In the following discussion, the patentability of the claims will be examined with regard to the requirements of the PCT. In particular, the claims will be examined for novelty, as defined in 33(2) PCT, and for inventive step, as defined in Art. 33(3) PCT. In addition other aspects, such as clarity requirements of Art. 6 PCT, may be discussed as appropriate.
- 2.1 The application lacks unity within the meaning of Rule 13 PCT, since the claims presently on file claim the following separate inventions or groups of inventions not so linked as to form a single general inventive concept. The application therefore does not comply with the requirements of Art. 3 (4)iii PCT. The application comprises the following separate inventions:

Invention 1. Claims 1-23

Invention 1 relates to **multiplex data transmission** via a wireless with different rates in each channel.

Invention 2. Claims 24-25

Invention 2 relates to a method and apparatus for **vibrational analysis** in a three dimensional space.

Since the applicant has paid additional fees under Art. 34 (3) a, **complete** examination of the application is carried out by the examiner.

For information only, the applicant may chose to prosecute the application on one of the above inventions in the national / regional phase of the application.

2.2 Claim 1

The subject matter of claim 1 of the application is not allowable because lacks an inventive step, Art. 33(3) PCT, the reasons being as follows:

Document D1 is considered to represent the closest prior art to the subject matter of claim 1 of the application. D1 discloses sensors (1,2,3) which are connected to a central control (5,6).

The examiner is of the opinion that it is an obvious problem in such a sensor/control arrangement that some sensors require a higher data rate than others.

The person skilled in the art, wishing to solve this problem would look to document D2. D2 discloses the multiplex control system for such a sensor/control arrangement but does not explicitly mention the control/sensors themselves.

D2 discloses that in a plurality of multiplexed channels (these could also be considered as sub-channels of a single channel), some channels with higher data rates are assigned correspondingly increased data transmission time slots, see abstract. The multiplexing of data is therefore asymmetrically arranged in accordance with the channel data carrying capacity.

The person skilled in the art, incorporating the teaching of D2 into the method/apparatus of D1 would therefore arrive at the subject matter of claim 1 of the application without having made an inventive step. Claim 1 is therefore not allowable under Art. 33(3) PCT.

It is further noted that the following clarity problems exist in claim 1 of the application.

- a. The expression "to receive data therefrom", in claim 1, lines 4-5, is unclear since from the sentence construction it is not clear from where the data is received.
- b. It is not clear what is meant by (the noun) "data processing function".
- c. It is not clear what is meant by "multiplexing division".

The above terms therefore need to be clarified in the claim.

2.3 Claims 2-12

The examiner is of the provisional opinion that the subject matter of claims 2 to 12 is of a routine nature and does therefore not involve an inventive step. The examiner also notes that although the subject matter of the claims is not known from a combination of D1 and D2, these relate largely to the area of application of the sensor/control arrangement. The technology of the application, for instance vibration sensing, is largely independent of the arrangements for data transmission.

2.4 Claim 13

Claim 13 relates to an apparatus for wireless transmission of data using multiplexed channels in which an asymmetric data rate in respective (so called sub-) channels is effected in accordance with **the different data rate requirements of local sensors.**

From the document D2, col. 1, lines 10-18 it is known to match data rate requirements with a particular channel transmission speed. The person skilled in the art would apply this principle to the specific example of data passing from a sensor without making an inventive step. The person skilled in the art would therefore incorporate this into the sensor / test arrangement of D1, see D1, fig. 1 and 2. In so doing, the person skilled in the art would assign channels in accordance with the different data rate requirements of respective sensors and so arrive exactly at the subject matter of claim 13 of the application without having

made an inventive step.

The subject matter of claim 13 is therefore obvious in the light of the available prior art D1 and D2, and as such not allowable under Art. 33(3) PCT.

2.5 Claims 14-23

Claims 14 to 23 would appear to relate to subject matter which is very diverse and of a routine nature. The examiner is therefore of the provisional opinion that the person skilled in the art would arrive at the subject matter of claims 14-23 as a matter of normal design procedure, starting from the obvious combination of D1 and D2. The subject matter of claims 14 to 23 is therefore not allowable under Art. 33(3) PCT.

2.6 Claim 24

Claims 24 and 25 relate to sensing in three dimensions. The closest prior art to claims 24 and 25 would appear to be D3. D3 also relates to vibration sensing in three dimensions.

Claim 24 is a method claim, D3 discloses:

- a. a method for vibration analysis of a machine or other article (see abstract) comprising;
 - a. providing a vibration sensor (1)
 - b. causing the sensor to sense vibrations (see abstract)
 - c. analysing signals produced by said sensor (15, see col. 5, lines 60-62)
 - d. providing the sensor with 3d location sensing means (D3, col. 6, lines 25-50)
 - e. causing a single vibration sensor to monitor 3 dimensions, (see fig. 2 and col. 4, lines 64-65 of D3) and using the coordinate measuring system to

measure the coordinates at these points (D3, col. 6, lines 25-50)

The subject matter of D3 differs from that of the application claim 24 only in that the feature:

- f. "identifying the location of a source of vibration accordingly" is not explicitly disclosed in D3. However, in col. 1, lines 15-25 of D3, it is disclosed that it is necessary to understand as accurately as possible the vibration characteristics of a machine etc.

In the opinion of the examiner, to identify the source of a vibration is an obvious desire of the person skilled in the art who wishes to understand "as accurately as possible" the vibration characteristics of a machine. Since the other features of claim 24 are not different from those of D3, the examiner is of the opinion that claim 24 of the application lacks an inventive step and as such is not allowable under Art. 33(3) PCT.

It is furthermore noted that claim 24 is not allowable under Art. 6 PCT since it lacks clarity. In particular the "said single vibration sensor" is not referred to previously in the claim, it should have been defined as a "single sensor" in feature a of the claim, if this is indeed the "said single sensor" to which reference is made in feature e.

2.7 Claim 25

Claim 25 is an apparatus claim which claims (in terms of an apparatus) the features a. to d. corresponding to those features a. to d. in claim 24.

As discussed above in part 2.6 of this opinion, these features are all known from the document D3, as such claim 25 is not new, and therefore does not fulfil the requirements of Art. 33(2) PCT.

- 3. In the following section, certain defects in the International Application will be noted.

**WRITTEN OPINION
SEPARATE SHEET**

International application No. PCT/GB98/00866

- 3.1 Document D1, D2 and D3 should be mentioned in the description in accordance with Rule 5.1 a ii PCT.
- 3.2 The description should be brought into accordance with any new claims to be filed in accordance with Rule 5.1 a iii PCT.
- 3.3 The independent claims should preferably be cast in the two part form of claim in accordance with Rule 6.3 b PCT, relative to the appropriate prior art.
- 4. The following points of clarity should be taken into account when filing new claims:
 - 4.1 To increase the clarity of the claims, reference signs relating to the drawings should be inserted into the claims between parentheses (). This applies to both the pre and post characterising portions of the claims.



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514 Rec'd PCT/PTO 09/402262
Urquhart-Dykes & Lord
01 OCT 1999

28 Rec'd PCT/PTO 01 OCT 1999

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Our ref: P53206WO/PBA/MB

14 April 1999

By Recorded Delivery - Advised Receipt
Copy By Fax (22 Pages)
PCT CHAPTER II MU DG2

Dear Sirs

INTERNATIONAL APPLICATION NUMBER : PCT/GB98/00866
SUN ELECTRIC UK LIMITED ET AL
RESPONSE TO FIRST WRITTEN OPINION

We are responding to the first written opinion setting a two month response period from 15 February 1999 and according to Rule 69.2 the final date for the International Preliminary Examination report is :

3 August 1999

leaving just under four months for the remainder of the procedure.

AMENDMENTS

We are filing herewith fair copy amended pages of the description and claims, as detailed below.

We request favourable reconsideration of the application, as amended, accordingly.

In the amended pages of the claims, there is included an "interpretation" edition of the amended claims in which the amendments made are identified by parentheses and underlining in the usual way. These amendments include amendment of the claims responsive to the defects noted in items 3.3 and 4.1 on sheet 6 of the separate sheets of the FWO.

Partners
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Robin Browne
Simon Belcher
Mark Green

Mark Davies
Alison Simpson
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Amended pages of the description include amendments responsive to items 3.1 and 3.2 of the said sheet 6.

UNITY OF INVENTION

The amendments adopted in the claims are not in themselves intended to be responsive to the unity of invention objection and the Applicants intend responding appropriately in this regard to the examination reports issued during the National and Regional phases.

CLAIMS 1 TO 23

We shall respond below to the objection with respect to inventive step raised against these claims, noting that we are in accord with the Examiner that these claims possess novelty with respect to the cited references.

INVENTIVE STEP OF CLAIMS 1 TO 23

Since International Preliminary Examination is being carried out at the EPO, and since published decisions with respect to inventive step available under International Preliminary Examination procedure are relatively not freely available (certainly in a comprehensive collection), we are dealing with the question of inventive step in accordance with the principles applied by the Boards of Appeal of the European Patent Office (third edition 1998). It is understood that these principles will apply, in any case in the European Regional phase in due course.

GENERAL

1. The present invention by its very nature is relatively simple in the sense that item c) of the characterising portion of claim 1 refers to allocating data from local data sensors to the sub-channels in accordance with the data carrying capacities of the sub-channels. It is submitted that care needs to be taken not to allow such simplicity to affect in any way the question of inventive step.
2. Indeed, there is warning in the Guidelines (chapter CIV, 9.9) against ex post facto analysis when assessing inventive step, particularly in relation to apparently simple inventions (see T24/81 and T564/89 and T645/92 and T795/93).

Established case law of the EPO Boards of Appeal has made clear that the relevant question is not whether the skilled person could have carried out the invention, but whether he would have done so in the hope of solving the underlying technical problem, or in the expectation of some improvement or advantage. So in this case, the question is not whether the skilled person could have arrived at the

invention by modifying documents D1 in accordance with the disclosure in document D2, but whether he would have done so because of promptings in these prior art documents (see T2/83 and T90/84 and T7/86 and T200/94).

3. So, what in fact is in the present case the underlying technical problem or the expectation of improvement or advantage in question? The answer to this is set out on pages 4 and 5 of the description of the present application which refers to such factors as economical use of available bandwidth and allocation of bandwidth corresponding to bandwidth requirements of the individual data sensors. The text on page 5 goes on to explain that prior proposals have ignored or overlooked these differing data rates or bandwidth requirements and this has led to a non-utilisation of sub-channel bandwidths whereby the overall utilisation of data transmission capacity allocated to a communications system has been very far from perfect. There is a reference to the twin evils of sub-channel under-utilisation and under-capacity (for a given data flow), and the avoidance of these.
4. Therefore, the disclosure in documents D1 and D2 is to be examined having regard to these latter-discussed technical problems and/or the improvements or advantages which might arise from reducing or eliminating them. Specifically, do documents D1 and D2 contain any relevant disclosure with regard to these problems and questions?
5. The disclosure in documents D1 may be summarised as follows:

"There is disclosed in US-A-4,738,133 an automotive testing system applicable to diagnostic analysis, in which prior art use of a plurality of cables or even an umbilical cord single cable (with digital signal conversion) is replaced by a wireless transmitter-receiver link interposed between the sensing transducers in the vehicle under test and the test apparatus. Transmission is by radio in the ultra short wave range, preferably in the gigahertz frequency range.

In accordance with a preferred feature of the disclosed invention the signals from the transducers are transmitted in time-multiplexed mode so that one transmitter can transmit signals from a plurality of transducers, and a plurality of signals from the engine of the vehicle can be transmitted sequentially through a single channel. Frequency multiplexed transmission is also possible whereby each sensor then has its own specific discrete transmission channel. There is no reference anywhere in the text or drawings to the bandwidth or data-carrying capacity of the transmission channels".

6. Turning now to the disclosure in document D2, the disclosure therein may be summarised as follows:

"There is disclosed in US-A-5 509 013 a multiplexer control system to control multiplexing of data of a plurality of channels including channels having different transmission speeds. It is stated that when multiplexing data of channels having different transmission speeds, data of channels having higher transmission speeds are more frequently multiplexed than data of channels having lower transmission speeds and the invention apparently seeks economically to realise a construction capable of multiplexing data on channels having different transmission speeds, and in accordance with the claimed invention this object is achieved by use of a multiplexer control system utilising a bit map memory, a rate setting memory and controlling means determining the multiplexing of the input data to the plurality of channels.

There is apparently no clear reference in the disclosure to the bandwidth or data-carrying capacity of the channels, and this is not surprising since apparently the channels are not wireless channels and therefore this reference apparently contains no disclosure of direct relevance to the question of channel capacity as opposed to channel transmission speed".

7. In view of the above-quoted disclosures in references D1 and D2, it can now be seen that the technical problem with which the present invention is concerned is not addressed in any direct way in either of the two principal cited references D1 and D2. Certainly, in D1 there is complete lack of awareness of the problem with which the present invention addresses. In simple terms, D1 is one of the prior proposals mentioned in paragraph 2 on page 5 of the present application which have ignored or overlooked these differing data rate requirements, with the result that the use of equal bandwidth sub-channels has led to(The various short comings there identified and quoted above).
8. As to D2, quite apart from the above-mentioned distinction between transmission speed and bandwidth or channel capacity, there is the basic point that the skilled person would (as opposed to could) not have even considered looking for disclosure relevant to the problem of bandwidth or channel capacity since certainly D1 and very arguably D2 also contain no reference to this.
9. Indeed, the absence of any reference to the channel capacity problem from the disclosure in D1 is of dominant significance because the skilled person is obliged to start from D1 since the disclosure in D2 is effectively merely of a multiplexer and provides few if any other features of

claim 1 of the present application. Therefore, starting from D1, the person skilled in the art is not even aware of the problem which the present invention solves, and does not even consider looking for disclosure solving such a problem.

10. The Examiner states his opinion (see section 2.2 on separate sheet 2 of the FWO) that it is an obvious problem in such sensor/control arrangement that some sensors require a higher data rate than others. However, the Guidelines warn against such an ex post facto approach when assessing inventive step, as mentioned above. In any case, even assuming, arguendo that the transducers disclosed in document D1 eg. trigger tongs for ignition pulses, voltmeters and ammeters, could be shown to have different data generating rates, there is simply no suggestion in D1 of doing anything to accommodate those different rates. Document D2 does deal with the handling of multiple channels having different transmission speeds. In particular, it is directed to a multiplexer control system for controlling the multiplexing of data from pre-existing channels which already have different data transmission rates. Furthermore, the system is dependent on the existence of these pre-existing channels of different data rates, since it must store information relating to the channel identifications and their transmission rates in the rate setting memory 12 which is critical to the operation of the system. It is submitted that there would have been no reason for one of ordinary skill in the art to attempt to use the system of document D2 which is based on pre-existing data channels of different data rates, in a system such as that of D1, which multiplexes data from channels which apparently have the same data rate. It is noted that in the system of D1, the wire conductors coming into the multiplexer and encoder 4a) could all have the same data rate even if the individual transducers 1-3 had different data-generating rates. That being the case, the multiplexer of D2 would not work in the system of D1.
11. Reverting specifically to the question of the disclosure or not in D2 of the concept of differing channel capacity or bandwidth, the following observations are made. As mentioned above, the specific textual disclosure relates solely to channels having "different transmission speeds". In this regard it is commented that channel data transmission speed as such and in the absence of any reference to channel capacity amounts to no more than a reference to the actual data transmission rate at any time rather than an upper limit to the data rate. The disclosure is explicit only as to the words actually used. Nowhere, apparently is there any reference to channel capacity or an upper limit to the data rate. This is significant. Also significant is the actual presence (column 2 at line 48) of a reference to changing the transmission speed of the

channel by employing a re-writeable memory. This endorses the absence of channel capacity disclosure.

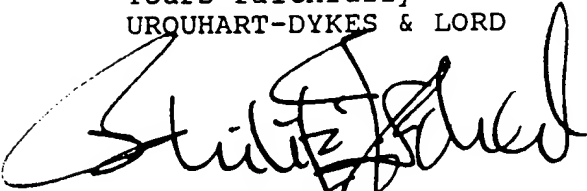
12. Summarising, it is submitted that D1 lacks all three features a), b) and c) of the characterising clause of claim 1. D1 also lacks any suggestion of the problem to be solved by the characterising features of claim 1. Therefore the skilled person aware of D1 would not search anywhere for the solution to the problem confronted by the present invention because that problem is unknown to him. Even if that skilled person consulted D2 in combination with D1, he would find that it was of little if any relevance. It discloses a multiplexing system relating to data transmission speeds. Data transmission speeds have no relevance to the disclosure of D1 since it contains no disclosure thereof. It does contain disclosure relating to multiplexing. It refers to time multiplexing and to frequency multiplexing. Neither of these systems relates in any practicable way to the multiplexing system of D2. Time multiplexing is in any case a single channel system. Therefore, the combination of D1 with D2 is not a combination which the skilled person would make. Even if the combination were made, arguably it would not produce the presently claimed invention since D2 arguably contains no disclosure of channels having differing carrying capacities but only disclosure of different actual data transmission rates.

CLAIMS 24 AND 25

1. The FWO indicates that claim 24 possesses novelty but lack inventive step, and claim 25 lacks novelty with respect to document D3.
2. Document D3 discloses a system for contactless detection of oscillations in an object by illuminating the object with a laser beam. By detecting reflected light from a point on the object with three spaced sensing heads, the system of D3 can locate the point by triangulation. By sensing light reflecting from a plurality of points on the object, the overall movement of the object can be determined in D3.
3. In view of the above-described disclosure in D3, claims 24 and 25 have been limited to a system wherein the vibration sensor is mechanically coupled to the machine or other article being sensed. It is submitted that with this amendment, both claims 24 and 25 have clear novelty with respect to D3 and moreover the cumulative effect of the additional features of novelty renders the disclosure of D3 significantly less pertinent whereby the technical advance to be made by the technically competent person as a matter of routine and non-inventive contribution to the state of the art in reaching the invention from D3 becomes

relatively unbridgeable.

Yours faithfully
UROUHART-DYKES & LORD

A large, stylized handwritten signature in black ink, appearing to read 'Philip B Archer', is written over the typed name and title.

PHILIP B ARCHER
AUTHORISED REPRESENTATIVE

- Encs. 1. Pages 4, 4a and 7 of the description - in triplicate.
2. Amended claims 1 to 25 (fair copy format) - in triplicate.
3. Amended claims 1 to 25 with identification of amendments by underlining and parentheses

times) and to individual channels within the groups (at transmission times) so as to increase throughput and reduce packet loss. For bursty traffic, the use of channel groups reduces the packet loss by several orders of magnitude.

5 EP 0 515 728A2 relates to a wireless indoor relay system. AU-A-18143/88 relates to a wireless data transmission link and notably a protocol for establishing a duplex link between first and second data link devices.

Other known references include:

10 GB 2295070

EP 0483549

EP 0268492

US 5509013

US 5448759

15 US 5363370

US 4,738,133 discloses a system for wireless transmission of multiplexed data from a plurality of transducers.

20 US 5,509,013 discloses a multiplexer control system for multiplexing the data from a plurality of input channels having different transmission speeds.

25 DE 4106572 discloses a system for contact-free measurement of object oscillations by directing laser light onto the object and detecting reflected light at plural spaced sensing heads so as to locate the point on the object from which the reflections are emanating.

30 According to the invention there is provided a method and apparatus for wireless transmission of data through a communications channel between at least two local data sensors with optional primary data processing and a data processing function, as defined in the accompanying claims.

35 In a described embodiment, there is provided a method and apparatus in which the step of multiplexing division of the communications channel is effected asymmetrically, whereby the data carrying capacities of the sub-channels are unequal. Likewise in the embodiment, the data rates required for data transmission from the local sensors

4a

differs substantially between the at least two sensors.
Likewise also in the embodiment, the step of allocating
data from the local data sensors to the data transmission
5 sub-channels is effected in accordance with the data-
carrying capacities of these sub-channels. In this way
there is achieved within a

vibrational analysis of machines and other articles and products and systems. In accordance with this aspect of the invention a vibration sensor, for example an NVH (noise vibration harshness) sensor is mechanically coupled
5 to the machine or other article to three-dimensionally locate a source of vibration in a machine or system. Such a sensor may be just one of the local sensors in the wireless transmission system of the other embodiments, or it may be provided with its own cable or other transmission
10 channel for its vibration signals.

In order to three-dimensionally locate a source of vibration, the vibration signals are monitored at three or more positionally-defined locations of the sensor. In the preferred embodiment the sensor is provided with its own
15 three-dimensional location or co-ordinate-defining system (utilising spaced infra-red sensors), so that the sensor's location at any given time is readily defined. Alternatively, the sensor may be caused to sense at three known locations, or three sensors may be provided, one each
20 at three such locations.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig 1 shows a functionality block diagram for a high
25 speed RF data link, including both the frequency multiplexing system (of Figs 2 and 3) and the time-division multiplexing system (of Figs 4 and 5 hereof);

Figs 2 and 3 show block diagrams of the transmitter and receiver functions of the system of Fig 1 as it applies
30 to a frequency multiplexing system;

Figs 4 and 5 show block diagrams of the transmitter and receiver functions of the system of Fig 1 as they apply to a time-division multiplexing system; and

CLAIMS

- 1 A method of wireless transmission of data in digital
and/or analogue format through a communications channel
5 (72) from at least two local data sensors (14, 16) to a
data processing means (24), said method comprising the
step of division of said channel into sub-channels and
transmitting said data from said data sensors respectively
through said sub-channels accordingly;
- 10 characterised by
- a) said step of division of said communications
channel being effected asymmetrically whereby the data
carrying capacities of said sub-channels are unequal; and
- b) the data rate required for data transmission from
15 said local sensors differing substantially between said at
least two sensors; and
- c) allocating data from said local data sensors to
respective ones or groups of said sub-channels [being
effected] in accordance with the data carrying capacities
20 of said sub-channels.
- 2 A method according to claim 1 characterised by said
step of division being effected on a frequency basis.
- 25 3 A method according to claim 1 characterised by said
step of division being effected on a time-division basis.
- 4 A method according to any one of claims 1 to 3
characterised by said step of division being adapted to
30 effect said division on an interdigitated non-chopping
data-allocation basis in which a degree of data element
transmission time overlap between channels is permitted.
- 5 A method according to claim 1 characterised by said
35 step of division being effected by packet-switching of data
from said local data sensors, and interleaving said data
packet with an unsymmetrical packet distribution.

6 A method according to any one of claims 1 to 5
characterised by said data processing means comprising a
host PC (24) having a series of virtual serial ports, and
5 said method comprising allocating each of said sub-channels
to a corresponding one of said virtual serial ports.

7 A method according to any one of claims 1 to 6
characterised by said local sensors comprising automotive
10 diagnostic and/or servicing sensors and said wireless
transmission of data being effected at radio frequencies.

8 A method according to any one of claims 1 to 7
characterised by at least one of said local sensors (14)
15 also providing a primary data-processing function.

9 A method according to any one of claims 1 to 8
characterised by said local sensors comprising vibration
sensor means (104) adapted to sense machine vibration, and
20 said method comprising transmitting said data therefrom.

10 A method according to claim 9 characterised by the
step of using as said sensors, sensors (104) adapted to
provide vibration data permitting noise vibration harshness
25 (NVH) analysis of the data.

11 A method according to claim 10 characterised by at
least three of said sensors being such NVH sensors, and the
method comprising employing said sensors at
30 three-dimensionally spaced locations to identify the
location or co-ordinates of a source of vibration.

12 A method according to claim 9 or claim 10
characterised by said vibration sensor means further
35 comprising three-dimensional location sensing means (106)
and the method comprising the step of using said sensor to
sense vibrations at three dimensionally-spaced locations in

sequence, and using said three-dimensional location sensing means to identify the location or co-ordinates of said three spaced locations so as to identify the location or co-ordinates of a source of vibration.

5

13 Apparatus for wireless transmission of data in digital and/or analogue format through a communications channel (12) from at least two local data sensors (14, 16) to a data processing means (24), the apparatus comprising a
10 multiplexer (62) adapted to effect division of said communications channel into sub-channels, and a transmitter (34) adapted to transmit said data through said sub-channels accordingly;

characterised by

15 a) said multiplexer being adapted to divide said communications channel asymmetrically whereby the data carrying capacities of said sub-channels are unequal; and
b) control means (40) adapted to allocate data from
20 said local data sensors to respective ones or groups of said communications sub-channels in accordance with substantially different data rate requirements from said local sensors.

14 Apparatus according to claim 13 characterised by said
25 multiplexer being adapted to effect said multiplexing on a frequency basis.

15 Apparatus according to claim 13 characterised by said
multiplexer being adapted to effect said multiplexing on a
30 time-division basis.

16 Apparatus according to any one of claims 13 to 15
characterised by said multiplexer being adapted to effect
said multiplexing on an interdigitated non-chopping
35 data-allocation basis in which a degree of data element transmission time-overlap between channels is permitted.

17 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect packet-switching of data from said local sources and to interleave said data packets with an unsymmetrical packet distribution.

5

18 Apparatus according to any one of claims 13 to 17 characterised by said data processing function comprising a host PC (24) having a series of virtual serial ports, and said control means being adapted to allocate each of said sub-channels to a respective one of said virtual ports.

10

19 Apparatus according to any one of claims 13 to 18 characterised by at least one of said local sensors (14) being adapted to provide a primary data-processing function.

15

20 Apparatus according to claim 19 characterised by said local sensors comprising vibration sensor means (104) adapted to sense machine vibration whereby said apparatus can transmit said vibration data from said vibration sensing means.

20

21 Apparatus according to claim 20 characterised by said local data sensors comprising sensors adapted to provide vibration data permitting noise vibration harshness (NVH) data for analysis thereof.

25

22 Apparatus according to claim 21 characterised by said local data sensors comprising at least three or more such NVH sensors whereby said sensors can be located at three-dimensionally spaced locations to provide data enabling identification of the location or co-ordinates of the source of a vibration in a machine.

30

23 Apparatus according to claim 20 or claim 21 characterised by said vibration sensor means further comprising three-dimensional location sensing means (106)

35

whereby said vibration sensor means can sense vibrations at three-dimensionally-spaced locations in sequence and said three-dimensional location sensing means can identify the co-ordinates or locations of said three locations so as to enable identification of the location or co-ordinates of a source of vibration.

24 A method for vibration analysis of a machine or other article comprising:

- 10 a) providing a vibration sensor (104);
- b) causing said sensor to sense vibrations;
- c) analysing signals produced by said sensor; characterised by
- d) providing said sensor with three-dimensional location sensing means (106);
- 15 e) causing said vibration sensor to be mechanically coupled to the machine or other article to sense vibrations at three-dimensionally-spaced locations and using said three-dimensional location sensing means to determine the co-ordinates of said three locations; and
- 20 f) identifying the location or co-ordinates of a source of vibration accordingly.

25 Apparatus for vibration analysis of a machine or other article comprising:

- a) a vibration sensor (104) adapted to sense vibrations at chosen locations; and
- b) analysis means (124) adapted to analyse signals produced by said sensor;
- 30 characterised by
- c) said vibration sensor being adapted to be mechanically coupled to the machine or other article and further comprising three-dimensional location sensing means (106);
- 35 d) whereby said single sensor can be caused to sense vibrations at three-dimensionally spaced locations at which said three-dimensional location sensing means can identify

the co-ordinate locations thereof whereby the corresponding co-ordinates of a source of vibration can be determined.

1 A method of wireless transmission of data in digital
and/or analogue format through a communications channel
(72) from at least two local data sensors (14, 16) to a
data processing means (24) [function to receive data
5 therefrom], said method comprising the step of
[multiplexing] division of said channel into sub-channels
and transmitting said data from said data sensors
respectively through said sub-channels accordingly;

characterised by

10 a) said step of [multiplexing] division of said
communications channel being effected asymmetrically
whereby the data carrying capacities of said sub-channels
are unequal; and

b) the data rate required for data transmission from
15 said local sensors differing substantially between said at
least two sensors; and

c) [the step of] allocating data from said local
data sensors to respective ones or groups of said
sub-channels [being effected] in accordance with the data
20 carrying capacities of said sub-channels.

2 A method according to claim 1 characterised by said
step of [multiplexing] division being effected on a
frequency basis.

25

3 A method according to claim 1 characterised by said
step of [multiplexing] division being effected on a
time-division basis.

30 4 A method according to any one of claims 1 to 3
characterised by said step of [multiplexing] division being
adapted to effect said [multiplexing] division on an
interdigitated non-chopping data-allocation basis in which
a degree of data element transmission time overlap between
35 channels is permitted.

5 A method according to claim 1 characterised by said

step of [multiplexing] division being effected by packet-switching of data from said local [sources] data sensors, and [the] interleaving [of] said data packet [being effected] with an unsymmetrical packet distribution.

5

6 A method according to any one of claims 1 to 5 characterised by said data processing [function] means comprising a host PC (24) having a series of virtual serial ports, and said method comprising allocating each of said
10 sub-channels to a corresponding one of said virtual serial ports.

15

7 A method according to any one of claims 1 to 6 characterised by said local sensors comprising automotive diagnostic and/or servicing sensors and said wireless
15 transmission of data being effected at radio frequencies.

20

8 A method according to any one of claims 1 to 7 characterised by at least one of said local sensors (14) also providing a primary data-processing function.

25

9 A method according to any one of claims 1 to 8 characterised by said local sensors comprising vibration sensor means (104) adapted to sense machine vibration, and
25 said method comprising transmitting said data therefrom.

30

10 A method according to claim 9 characterised by the step of using as said sensors, sensors (104) adapted to provide vibration data permitting noise vibration harshness (NVH) analysis [thereof] of the data.

35

11 A method according to claim 10 characterised by at least three of said sensors being such NVH sensors, and the method comprising employing said sensors at
35 three-dimensionally spaced locations to identify the location or co-ordinates of a source of vibration.

12 A method according to claim 9 or claim 10
characterised by said vibration sensor means further
comprising three-dimensional location sensing means (106)
and the method comprising the step of using said [single]
5 sensor to sense vibrations at three dimensionally-spaced
locations in sequence, and using said three-dimensional
location sensing means to identify the location or
co-ordinates of said three spaced locations so as to
identify the location or [co-ordinate] co-ordinates of a
10 source of vibration.

13 Apparatus for wireless transmission of data in digital
and/or analogue format through a communications channel
(12) from at least two local data sensors (14, 16) to a
15 data processing means (24) [function to receive data
therefrom], the apparatus comprising a multiplexer (62)
adapted to effect division of said communications channel
into sub-channels, and a transmitter (34) adapted to
transmit said data through said sub-channels accordingly;

20 characterised by
a) said multiplexer being adapted to divide said
communications channel asymmetrically whereby the data
carrying capacities of said sub-channels are unequal; and
b) control means (40) adapted to allocate data from
25 said local data sensors to respective ones or groups of
said communications sub-channels in accordance with
substantially different data rate requirements from said
local sensors.

30 14 Apparatus according to claim 13 characterised by said
multiplexer being adapted to effect said multiplexing on a
frequency basis.

35 15 Apparatus according to claim 13 characterised by said
multiplexer being adapted to effect said multiplexing on a
time-division basis.

16 Apparatus according to any one of claims 13 to 15
characterised by said multiplexer being adapted to effect
said multiplexing on an interdigitated non-chopping
data-allocation basis in which a degree of data element
5 transmission time-overlap between channels is permitted.

17 Apparatus according to claim 13 characterised by said
multiplexer being adapted to effect packet-switching of
data from said local sources and to interleave said data
10 packets with an unsymmetrical packet distribution.

18 Apparatus according to any one of claims 13 to 17
characterised by said data processing function comprising
a host PC (24) having a series of virtual serial ports, and
15 said control means being adapted to allocate each of said
sub-channels to a respective one of said virtual ports.

19 Apparatus according to any one of claims 13 to 18
characterised by at least one of said local sensors (14)
20 being adapted to provide a primary data-processing
function.

20 Apparatus according to claim 19 characterised by said
local sensors comprising vibration sensor means (104)
25 adapted to sense machine vibration whereby said apparatus
can transmit said vibration data [therefrom] from said
vibration sensing means.

21 Apparatus according to claim 20 characterised by said
30 local data sensors comprising sensors adapted to provide
vibration data permitting noise vibration harshness (NVH)
data for analysis thereof.

22 Apparatus according to claim 21 characterised by said
35 local data sensors comprising at least three or more[,]
such NVH sensors whereby said sensors can be located at
three-dimensionally spaced locations to provide data

enabling identification of the location or co-ordinates of the source of a vibration in a machine.

23 Apparatus according to claim 20 or claim 21
5 characterised by said vibration sensor means further comprising three-dimensional location sensing means (106) whereby said [single] vibration sensor means can sense vibrations at three-dimensionally-spaced locations in sequence and said three-dimensional location sensing means
10 can identify the co-ordinates or locations of said three locations so as to enable identification of the location or co-ordinates of a source of vibration.

24 A method for vibration analysis of a machine or other
15 article comprising :
a) providing a vibration sensor (104);
b) causing said sensor to sense vibrations;
c) analysing signals produced by said sensor;
characterised by
20 d) providing said sensor with three-dimensional location sensing means (106);
e) causing said [single] vibration sensor to be mechanically coupled to the machine or other article to
25 sense vibrations at three-dimensionally-spaced locations and using said three-dimensional location sensing means to determine the co-ordinates of said three locations; and
f) identifying the location or co-ordinates of a source of vibration accordingly.

30 25 Apparatus for vibration analysis of a machine or other article comprising:
a) a vibration sensor (104) adapted to sense vibrations at chosen locations; and
b) analysis means (124) adapted to analyse signals
35 produced by said sensor;
characterised by
c) said vibration sensor being adapted to be

mechanically coupled to the machine or other article and
further comprising three-dimensional location sensing means
(106);

- 5 d) whereby said single sensor can be caused to sense
vibrations at three-dimensionally spaced locations at which
said three-dimensional location sensing means can identify
the co-ordinate locations thereof whereby the corresponding
co-ordinates of a source of vibration can be determined.

times) and to individual channels within the groups (at transmission times) so as to increase throughput and reduce packet loss. For bursty traffic, the use of channel groups reduces the packet loss by several orders of magnitude.

EP 0 515 728A2 relates to a wireless indoor relay system. AU-A-18143/88 relates to a wireless data transmission link and notably a protocol for establishing a duplex link between first and second data link devices.

Other known references include :-

GB 2295070

EP 0483549

EP 0268492

US 5509013

US 5448759

US 5363370

According to the invention there is provided a method and apparatus for wireless transmission of data through a communications channel between at least two local data sensors with optional primary data processing and a data processing function, as defined in the accompanying claims.

In a described embodiment, there is provided a method and apparatus in which the step of multiplexing division of the communications channel is effected asymmetrically, whereby the data carrying capacities of the sub-channels are unequal. Likewise in the embodiment, the data rates required for data transmission from the local sensors differs substantially between the at least two sensors. Likewise also in the embodiment, the step of allocating data from the local data sensors to the data transmission sub-channels is effected in accordance with the data-carrying capacities of these sub-channels. In this way there is achieved within a

vibrational analysis of machines and other articles and products and systems. In accordance with this aspect of the invention a vibration sensor, for example an NVH (noise vibration harshness) sensor is
5 utilised to three-dimensionally locate a source of vibration in a machine or system. Such a sensor may be just one of the local sensors in the wireless transmission system of the other embodiments, or it may be provided with its own cable or other
10 transmission channel for its vibration signals.

In order to three-dimensionally locate a source of vibration, the vibration signals are monitored at three or more positionally-defined locations of the sensor. In the preferred embodiment the sensor is
15 provided with its own three-dimensional location or co-ordinate-defining system (utilising spaced infrared sensors), so that the sensor's location at any given time is readily defined. Alternatively, the sensor may be caused to sense at three known
20 locations, or three sensors may be provided, one each at three such locations.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

25 Fig 1 shows a functionality block diagram for a high speed RF data link, including both the frequency multiplexing system (of Figs 2 and 3) and the time-division multiplexing system (of Figs 4 and 5 hereof);

30 Figs 2 and 3 show block diagrams of the transmitter and receiver functions of the system of Fig 1 as it applies to a frequency multiplexing system;

35 Figs 4 and 5 show block diagrams of the transmitter and receiver functions of the system of Fig 1 as they apply to a time-division multiplexing system; and

CLAIMS

- 1 A method of wireless transmission of data in
digital and/or analogue format through a
communications channel from at least two local data
5 sensors to a data processing function to receive data
therefrom, said method comprising the step of
multiplexing division of said channel into sub-
channels and transmitting said data from said data
sensors through said sub-channels accordingly;
- 10 characterised by
- a) said step of multiplexing division of said
communications channel being effected asymmetrically
whereby the data carrying capacities of said sub-
channels are unequal; and
- 15 b) the data rate required for data transmission
from said local sensors differing substantially
between said at least two sensors; and
- c) the step of allocating data from said local
data sensors to respective ones or groups of said sub-
20 channels being effected in accordance with the data
carrying capacities of said sub-channels.
- 2 A method according to claim 1 characterised by
said step of multiplexing being effected on a
frequency basis.
- 25 3 A method according to claim 1 characterised by
said step of multiplexing being effected on a time-
division basis.
- 4 A method according to any one of claims 1 to 3
characterised by said step of multiplexing being
30 adapted to effect said multiplexing on an
interdigitated non-chopping data-allocation basis in
which a degree of data element transmission time

overlap between channels is permitted.

5 A method according to claim 1 characterised by said step of multiplexing being effected by packet-switching of data from said local sources, and the
5 interleaving of said data packet being effected with an unsymmetrical packet distribution.

6 A method according to any one of claims 1 to 5 characterised by said data processing function comprising a host PC having a series of virtual serial
10 ports, and said method comprising allocating each of said sub-channels to a corresponding one of said virtual serial ports.

7 A method according to any one of claims 1 to 6 characterised by said local sensors comprising
15 automotive diagnostic and/or servicing sensors and said wireless transmission of data being effected at radio frequencies.

8 A method according to any one of claims 1 to 7 characterised by at least one of said local sensors
20 also providing a primary data-processing function.

9 A method according to any one of claims 1 to 8 characterised by said local sensors comprising
vibration sensor means adapted to sense machine vibration, and said method comprising transmitting
25 said data therefrom.

10 A method according to claim 9 characterised by the step of using as said sensors, sensors adapted to provide vibration data permitting noise vibration harshness (NVH) analysis thereof.

11 A method according to claim 10 characterised by
at least three of said sensors being such NVH sensors,
and the method comprising employing said sensors at
three-dimensionally spaced locations to identify the
5 location or co-ordinates of a source of vibration.

12 A method according to claim 9 or claim 10
characterised by said vibration sensor means further
comprising three-dimensional location sensing means
and the method comprising the step of using said
10 single sensor to sense vibrations at three
dimensionally-spaced locations in sequence, and using
said three-dimensional location sensing means to
identify the location or co-ordinates of said three
spaced locations so as to identify the location or co-
15 ordinate of a source of vibration.

13 Apparatus for wireless transmission of data in
digital and/or analogue format through a
communications channel from at least two local data
sensors to a data processing function to receive data
20 therefrom, the apparatus comprising a multiplexer
adapted to effect division of said communications
channel into sub-channels, and a transmitter adapted
to transmit said data through said sub-channels
accordingly;

25 characterised by

a) said multiplexer being adapted to divide
said communications channel asymmetrically whereby the
data carrying capacities of said sub-channels are
unequal; and

30 b) control means adapted to allocate data from
said local data sensors to respective ones or groups
of said communications sub-channels in accordance with
substantially different data rate requirements from
said local sensors.

14 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect said multiplexing on a frequency basis.

5 15 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect said multiplexing on a time-division basis.

10 16 Apparatus according to any one of claims 13 to 15 characterised by said multiplexer being adapted to effect said multiplexing on an interdigitated non-chopping data-allocation basis in which a degree of data element transmission time-overlap between channels is permitted.

15 17 Apparatus according to claim 13 characterised by said multiplexer being adapted to effect packet-switching of data from said local sources and to interleave said data packets with an unsymmetrical packet distribution.

20 18 Apparatus according to any one of claims 13 to 17 characterised by said data processing function comprising a host PC having a series of virtual serial ports, and said control means being adapted to allocate each of said sub-channels to a respective one of said virtual ports.

25 19 Apparatus according to any one of claims 13 to 18 characterised by at least one of said local sensors being adapted to provide a primary data-processing function.

30 20 Apparatus according to claim 19 characterised by said local sensors comprising vibration sensor means adapted to sense machine vibration whereby said

apparatus can transmit said vibration data therefrom.

21 Apparatus according to claim 20 characterised by said local data sensors comprising sensors adapted to provide vibration data permitting noise vibration
5 harshness (NVH) data for analysis thereof.

22 Apparatus according to claim 21 characterised by said local data sensors comprising at least three or more, such NVH sensors whereby said sensors can be located at three-dimensionally spaced locations to
10 provide data enabling identification of the location or co-ordinates of the source of a vibration in a machine.

23 Apparatus according to claim 20 or claim 21 characterised by said vibration sensor means further
15 comprising three-dimensional location sensing means whereby said single vibration sensor can sense vibrations at three-dimensionally-spaced locations in sequence and said three-dimensional location sensing means can identify the co-ordinates or locations of
20 said three locations so as to enable identification of the location or co-ordinates of a source of vibration.

24 A method for vibration analysis of a machine or other article comprising :

- a) providing a vibration sensor;
- 25 b) causing said sensor to sense vibrations;
- c) analysing signals produced by said sensor; characterised by
- d) providing said sensor with three-dimensional location sensing means;
- 30 e) causing said single vibration sensor to sense vibrations at three-dimensionally-spaced locations and using said three-dimensional location

sensing means to determine the co-ordinates of said three locations; and

f) identifying the location or co-ordinates of a source of vibration accordingly.

5 25 Apparatus for vibration analysis of a machine or other article comprising :

 a) a vibration sensor adapted to sense vibrations at chosen locations; and

 b) analysis means adapted to analyse signals
10 produced by said sensor;

 characterised by

 c) said vibration sensor further comprising three-dimensional location sensing means;

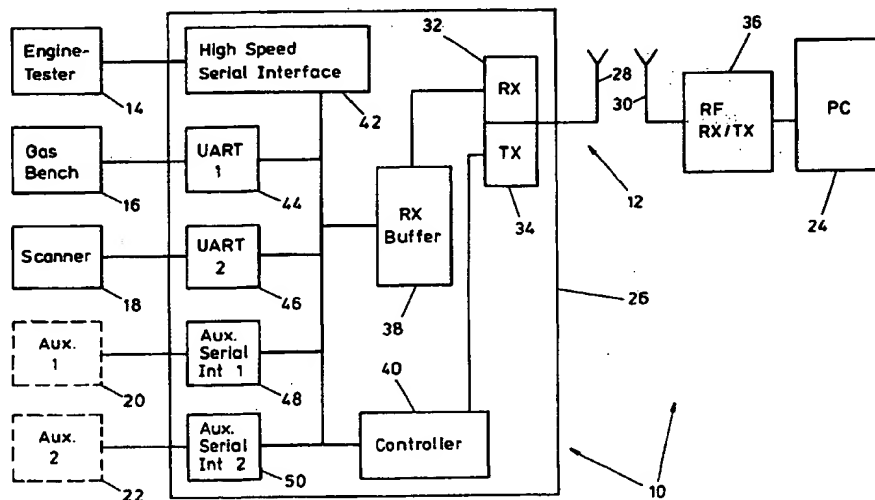
 d) whereby said single sensor can be caused to
15 sense vibrations at three dimensionally spaced locations at which said three-dimensional location sensing means can identify the co-ordinate locations thereof whereby the corresponding co-ordinates of a source of vibration can be determined.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | | |
|--|--|--|--|
| (51) International Patent Classification ⁶ : G08C 15/02 | | A2 | (11) International Publication Number: WO 98/44471 |
| | | | (43) International Publication Date: 8 October 1998 (08.10.98) |
| (21) International Application Number: PCT/GB98/00866 (22) International Filing Date: 3 April 1998 (03.04.98) (30) Priority Data: 9706797.9 3 April 1997 (03.04.97) GB (71) Applicant (for all designated States except US): SUN ELECTRIC UK LIMITED [GB/GB]; Unit 12, Horsleys Fields, King's Lynn, Norfolk PE30 5DD (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): JONES, Barbara, Lynn [GB/GB]; Sun Electric UK Limited, Unit 12, Horsleys Fields, King's Lynn, Norfolk PE30 5DD (GB). SMITH, Paul [GB/GB]; Sun Electric Limited, Unit 12, Horsleys Fields, King's Lynn, Norfolk, PE30 5DD (GB). (74) Agent: ARCHER, Philip, Bruce; Urquhart-Dykes & Lord, New Priestgate House, 57 Priestgate, Peterborough, Cambs PE1 1JX (GB). | | (81) Designated States: AU, CA, CN, JP, KR, MX, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published Without international search report and to be republished upon receipt of that report. | |

(54) Title: WIRELESS MULTIPLEX DATA TRANSMISSION SYSTEM



(57) Abstract

A method and apparatus for wireless transmission of data through a communications channel between at least two local data sensors (for example automotive diagnostic data sensors or NVH sensors), which may include a primary data-processing function, and data-processing function (for example a PC) to receive data therefrom. The system provides for asymmetrical division of the communications channel on a frequency or time-division or packet-switching basis so that the corresponding asymmetrical data transmission requirement of the local data sensors are matched to the capacity of their respective sub-channels whereby a single channel is capable of transmitting all the required data. A particularly practical application is to noise vibration harshness analysis of wireless-transmitted data from three-dimensionally spaced NVH sensors enabling spacial pinpointing of vibration sources in automotive warranty analysis studies.

From the INTERNATIONAL BUREAU

28 Rec'd PCT/PTO 01 OC 1998

**NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES**

(PCT Rule 47.1(c), first sentence)

ARCHER, Philip, Bruce
Urquhart-Dykes & Lord
New Priestgate House
57 Priestgate
Peterborough
Cambs PE1 1JX
Royaume-Uni

| | | | |
|--|--|--|--|
| Date of mailing (day/month/year) 08 October 1998 (08.10.98) | | IMPORTANT NOTICE | |
| Applicant's or agent's file reference P53206WO | | | |
| International application No. PCT/GB98/00866 | International filing date (day/month/year) 03 April 1998 (03.04.98) | Priority date (day/month/year) 03 April 1997 (03.04.97) | |
| Applicant SUN ELECTRIC UK LIMITED et al | | | |

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU, CA, CN, EP, JP, KR, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
MX

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 08 October 1998 (08.10.98) under No. WO 98/44471

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

| | |
|---|---------------------------------|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland | Authorized officer J. Zahra |
| Facsimile No. (41-22) 740.14.35 | Telephone No. (41-22) 338.83.38 |

PATENT COOPERATION TREATY

28 Rec'd PCT/PTO 01 OCT 1999 PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|--|---|---|
| Applicant's or agent's file reference P53206WO | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416) FOR FURTHER ACTION | |
| International application No. PCT/GB98/00866 | International filing date (day/month/year) 03/04/1998 | Priority date (day/month/year) 03/04/1997 |
| International Patent Classification (IPC) or national classification and IPC G08C15/02 | | |
| Applicant SUN ELECTRIC UK LIMITED et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 11 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

| | |
|---|---|
| Date of submission of the demand 03/11/1998 | Date of completion of this report <div style="text-align: center; font-size: 1.2em; font-weight: bold;">29. 04. 99</div> |
| Name and mailing address of the international preliminary examining authority: <div style="display: flex; align-items: center;"> <div> European Patent Office D-80298 Munich Tel. (+49-89) 2399-0 Tx: 523656 epmu d Fax: (+49-89) 2399-4465 </div> </div> | Authorized officer Wright, J Telephone No. (+49-89) 2399 2705 |



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB98/00866

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-3,5,6,8-14 as originally filed

4,4a,7 as received on 17/04/1999 with letter of 14/04/1999

Claims, No.:

1-25 as received on 17/04/1999 with letter of 14/04/1999

Drawings, sheets:

1/4-4/4 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
☒ paid additional fees.
☐ paid additional fees under protest.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB98/00866

- ☐ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
- ☒ not complied with for the following reasons:
- see separate sheet**
4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:
- ☒ all parts.
- ☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|-------------------|
| Novelty (N) | Yes: | Claims | 1-25 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 2,4,5,14,16,17 |
| | No: | Claims | 1,3,6-13,15,18-25 |
| Industrial applicability (IA) | Yes: | Claims | 1-25 |
| | No: | Claims | |

2. Citations and explanations

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB98/00866

1. The following document(s) will be referred to in this preliminary examination report;

D1 US-A-4 738 133 [Breckel et al]
D2 US-A-5 509 013 [Adachi et al]
D3 DE-A-4 106 572 [Fraunhofer Gesellschaft München]

The subject-matter of document D1 is considered to represent the prior art the closest to that of the present application, inventions 1 and 2.

2. In the following discussion, the patentability of the claims will be examined with regard to the requirements of the PCT. In particular, the claims will be examined for novelty, as defined in Art. 33(2) PCT, and for inventive step, as defined in Art. 33(3) PCT. In addition other aspects, such as clarity requirements of Art. 6 PCT, may be discussed as appropriate.
- 2.1 The application lacks unity within the meaning of Rule 13 PCT, since the claims presently on file claim the following separate inventions or groups of inventions not so linked as to form a single general inventive concept. The application therefore does not comply with the requirements of Art. 3 (4)iii PCT. The application comprises the following separate inventions:

Invention 1. Claims 1-23

Invention 1 relates to **multiplex data transmission** via a wireless with different rates in each channel.

Invention 2. Claims 24-25

Invention 2 relates to a method and apparatus for **vibrational analysis** in a three dimensional space.

Since the applicant has **paid additional fees** under Art. 34 (3) a, **report on the complete application** will be made by the examiner.

For information only, the applicant may chose to prosecute the application on one

of the above inventions in the national / regional phase of the application.

2.2 Claim 1

The subject matter of claim 1 of the application is not allowable because it lacks an inventive step, Art. 33(3) PCT, the reasons being as follows:

Document D1 is considered to represent the closest prior art to the subject matter of claim 1 of the application. D1 discloses sensors (1,2,3) which are connected to a central control (5,6).

The examiner is of the opinion that it is a common and obvious problem in such a sensor/control arrangement that some sensors require a higher data carrying capacity than others. The problem is for instance known from the document D2, see for instance col. 1, lines 16-18.

The examiner notes that although D2 specifically relates to channels having varying "transmission speeds" this means different "data carrying capacity", since data carrying capacity only has meaning in terms of a given time period during which data can be sent. Nothing in claim 1 of the application refers to channel band-width or the like.

The person skilled in the art, wishing to solve this problem would use the solution proposed in document D2. D2 discloses the multiplex control system for such a sensor/control arrangement but does not explicitly mention the control/sensors themselves.

D2 discloses that in a plurality of multiplexed channels (these are considered to be sub-channels of a single channel), some channels with higher data rates are assigned correspondingly increased data transmission load, see abstract, col. 6, lines 28-32 (gives a definition of a "cell" and col. 7, lines 14-24 (which defines how data is asymmetrically divided in accordance with the data carrying capacity of the sub-channels) and col. 7, lines 33-37 (dynamic changing of channel data transmission

capability). The multiplexing of data is therefore asymmetrically arranged in accordance with the channel data carrying capacity.

The person skilled in the art, incorporating the teaching of D2 into the method/apparatus of D1 would therefore arrive at the subject matter of claim 1 of the application without having made an inventive step.

The above argument hinges on the question of whether the person skilled in the art **would combine** D1 and D2. The examiner notes that D2 does not address the specific environment of data collection from sensors, rather it addresses the more general problem of transmitting by what ever means data from one remote location to another by means of transmission channels of some kind. The examiner furthermore notes that the solution offered to the above problem in D2 which is the same as in the application, has no technical features which relate to the kind of data generated, the means of transmission or to the source of data. The examiner furthermore notes that nearly all data is actually sourced from some kind of sensor, be it a microphone in a telephone, a pressure sensor or a light responsive sensor in a FAX machine.

The examiner concludes that the problem posed in D2 is very general to the field of data transmission and the person skilled in the art would therefore be very aware of this problem when dealing with any data transmission. The features of claim 1 of the application (known in themselves from D1) are merely contextual and do not add technical features which would be considered to involve an inventive step.

Claim 1 is therefore not allowable under Art. 33(3) PCT.

The examiner notes that claim 1 would appear to be clear and therefore to satisfy the requirements of Art. 6 PCT.

2.3 Claims 2 to 5

The examiner notes that claims 2 to 5 relate to the way in which the channels are divided.

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From D2, col. 1, lines 54-64 it would appear that the channel division is on a time division basis. The examiner is now of the provisional opinion that claim 3 of the application lacks inventive step, but that the division in accordance with claim 2 could be considered as being both new and involving an inventive step since there is no indication in the prior art to use frequency division.

The examiner is of the provisional opinion that the subject matter of claims 5 could likewise be considered to involve an inventive step, since packet switching is also not known from the available prior art D1 or D2.

The examiner considers that the subject matter of claim 4 **could** contain subject matter which involved an inventive step, but that it is so unclear to the examiner what is being claimed that the present claim does not satisfy the requirements of Art. 6 PCT.

In particular the examiner is not aware of the term "interdigitated non-chopping data-allocation basis" with regard to channel division /multiplexing etc. Furthermore the criteria that a "degree" of data element transmission time overlap is permitted is indefinite and vague.

The applicant is also informed for information only that the examiner is of the provisional opinion that any independent claim (in the regional or national phase of the application) based on the division mechanism, e.g. frequency division, would not be acceptable if based on alternatives, i.e. only one mechanism could be considered as constituting one unifying inventive concept, since the more general concept of the application is already known from D2.

2.4 Claims 6-12

Although the subject matter of the claims 6-12 is not per se known from a combination of D1 and D2, these relate largely to the area of application of the sensor/control arrangement. The technology of the application, for instance vibration sensing, is considered to be independent of the arrangements for data transmission. As such these

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International application No. PCT/GB98/00866

claims represent various juxtapositions of features which would appear to be known in themselves, as such the examiner considers them not to involve an inventive step, Art. 33(3) PCT.

It is furthermore noted that claim 10 lacks clarity, Art. 6 PCT. The reason being that a reference in parenthesis to "NVH" would appear not to be a reference to the drawings but an attempt to define a short form for "noise vibration harshness".

The term "NVH" is then used without brackets in claim 22 and with brackets in claim 21. In the opinion of the examiner the brackets with the term "NVH" should not be used in any of the claims.

2.5 Claim 13

Claim 13 relates to an apparatus for wireless transmission of data using divided channels in which an asymmetric data rate in respective (so called sub-) channels is effected in accordance with **the different data rate requirements of local sensors**.

From the document D2, col. 1, lines 10-18 it is known to match data rate requirements with a particular channel transmission speed. The person skilled in the art would apply this principle to the specific example of data passing from a sensor without making an inventive step. The person skilled in the art would therefore incorporate this into the sensor / test arrangement of D1, see D1, fig. 1 and 2. In so doing, the person skilled in the art would assign channels in accordance with the different data rate requirements of respective sensors and so arrive exactly at the subject matter of claim 13 of the application without having made an inventive step.

The subject matter of claim 13 is therefore obvious in the light of the available prior art D1 and D2, and as such not allowable under Art. 33(3) PCT.

2.5 Claims 14-17

Claims 14 to 17 correspond to the method claims 2-5. For the reasons given above the examiner considers that claim 15 lacks an inventive step, time division being known from D2. Claims 14 and 17 could be considered to involve an inventive step and claim 16 could contain patentable subject matter but is so unclear, Art. 6 PCT, that it is not possible to be more specific as to any inventive quality of the claim.

2.6 Claims 18-23

Claims 18-23 comprise subject matter which is of a routine nature. The examiner is therefore of the provisional opinion that the person skilled in the art would arrive at the subject matter of claims 14-23 as a matter of normal design procedure, starting from the obvious combination of D1 and D2. The subject matter of claims 14 to 23 is therefore not allowable under Art. 33(3) PCT.

2.6 Claim 24

Claims 24 and 25 relate to sensing in three dimensions. The closest prior art to claims 24 and 25 would appear to be D3. D3 also relates to vibration sensing in three dimensions.

Claim 24 is a method claim, D3 discloses:

- a. a method for vibration analysis of a machine or other article (see abstract) comprising;
 - a. providing a vibration sensor (1)
 - b. causing the sensor to sense vibrations (see abstract)
 - c. analysing signals produced by said sensor (15, see col. 5, lines 60-62)
 - d. providing the sensor with 3d location sensing means (D3, col. 6, lines 25-50)
 - e. causing a single vibration sensor to monitor 3 dimensions, (see fig. 2 and col. 4,

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lines 64-65 of D3) and using the coordinate measuring system to measure the coordinates at these points (D3, col. 6, lines 25-50)

The subject matter of D3 differs from that of the application claim 24 only in that the features:

f. "identifying the location of a source of vibration accordingly" is not explicitly disclosed in D3;

and the feature of mechanical contact is not disclosed in D3, D3 operating with light beams.

However, in col. 1, lines 15-25 of D3, it is disclosed that it is necessary to understand as accurately as possible the vibration characteristics of a machine etc.

In the opinion of the examiner, to identify the source of a vibration is an obvious desire of the person skilled in the art who wishes to understand "as accurately as possible" the vibration characteristics of a machine.

In addition the examiner is of the opinion that the choice of sensor, being light beam sensor or a mechanical sensor is merely one of design choice which the person skilled in the art would make without having made an inventive step.

Since the other features of claim 24 are not different from those of D3, the examiner is of the opinion that claim 24 of the application lacks an inventive step and as such is not allowable under Art. 33(3) PCT.

It is furthermore noted that claim 24 is not allowable under Art. 6 PCT since it lacks clarity. In particular the "said three locations" (line 26) are not actually previously referred to in the claim. It would appear that the author of the claim confuses "three-dimensions" with three locations, in the opinion of the examiner a single point can be defined in "three-dimensions" and this in no way implies there to be three points.

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2.7 Claim 25

Claim 25 is an apparatus claim which claims (in terms of an apparatus) the features a. to d. corresponding to those features a. to d. in claim 24.

As discussed above in part 2.6 of this opinion, these features are all known from the document D3, except for the feature of mechanical sensing. As discussed above the examiner is of the opinion that this combination of features lacks an inventive step as such claim 25 does not fulfil the requirements of Art. 33(3) PCT.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference P53206W0 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/GB 98/ 00866 | International filing date (day/month/year) 03/04/1998 | (Earliest) Priority Date (day/month/year) 03/04/1997 |
| Applicant SUN ELECTRIC UK LIMITED et al. | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).

2. ☒ Unity of invention is lacking (see Box II).

3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.

☐ furnished by the applicant separately from the international application,

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ Transcribed by this Authority

4. With regard to the title, ☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

WIRELESS MULTIPLEX DATA TRANSMISSION SYSTEM

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 1 ☒ as suggested by the applicant.

☐ None of the figures.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GS 98/00866

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G08C15/02 G08C17/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G08C G01R H04J G01H A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|--|
| Y A | US 4 738 133 A (BRECKEL ET AL) 19 April 1988 see abstract see column 1, line 63 - column 2, line 31; figures 1,2 --- | 1-3,7, 13-15 4-6,8, 16-19 |
| Y A | GB 2 295 070 A (ALPS ELECTRIC CO. LTD.) 15 May 1996 cited in the application see abstract --- | 1-3,7, 13-15 4-6,8, 16-19 |
| A | US 5 509 013 A (ADACHI ET AL) 16 April 1996 cited in the application see abstract see column 1, line 19 - line 64; figure 1 --- | 5,17 |
| -/- | | |

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

29 October 1998

Date of mailing of the international search report

18.11.98

Name and mailing address of the ISA

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Authorized officer

O'Reilly, D

INTERNATIONAL SEARCH REPORT

Intern. Application No.

PCT/GB 98/00866

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| A | DE 41 31 341 A (MERCEDES-BENZ AKTIENGESELLSCHAFT) 26 November 1992 see abstract see column 1, line 53 - line 64; figures 1,2 --- | 2,14 |
| A | DE 41 06 572 A (FRAUNHOFER-GESELLSCHAFT) 3 September 1992 see abstract see column 2, line 20 - line 29; figure 2 --- | 24,25 |
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| A,P | US 5 622 170 A (SCHULTZ) 22 April 1997 cited in the application see abstract see column 4, line 25 - line 49; figure 1A ----- | 24,25 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/GB 98/00866

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 98/00866

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-23

Multiplex data transmission via a wireless with different rates in each channel

2. Claims: 24,25

Vibration analysis using a sensor

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

ARCHER, Philip, Bruce
Urquhart-Dykes & Lord
New Priestgate House
57 Priestgate
Peterborough
Cambs PE1 1JX
ROYAUME-UNI

| | |
|--|--|
| Date of mailing (day/month/year) 30 September 1999 (30.09.99) | IMPORTANT NOTIFICATION |
| Applicant's or agent's file reference P53206WO | |
| International application No. PCT/GB98/00866 | International filing date (day/month/year) 03 April 1998 (03.04.98) |

| | | |
|--|---|--|
| 1. The following indications appeared on record concerning: | | |
| <input checked="" type="checkbox"/> the applicant | <input type="checkbox"/> the inventor | <input type="checkbox"/> the agent <input type="checkbox"/> the common representative |
| Name and Address SUN ELECTRIC UK LIMITED Unit 12 Horsleys Fields King's Lynn Norfolk PE30 5DD United Kingdom | State of Nationality GB | State of Residence GB |
| | Telephone No. | |
| | Facsimile No. | |
| | Teleprinter No. | |
| 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning: | | |
| <input type="checkbox"/> the person | <input checked="" type="checkbox"/> the name | <input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence |
| Name and Address SNAP-ON EQUIPMENT LIMITED Unit 12 Horsleys Fields King's Lynn Norfolk PE30 5DD United Kingdom | State of Nationality GB | State of Residence GB |
| | Telephone No. | |
| | Facsimile No. | |
| | Teleprinter No. | |
| 3. Further observations, if necessary: | | |
| 4. A copy of this notification has been sent to: | | |
| <input checked="" type="checkbox"/> the receiving Office | <input type="checkbox"/> the designated Offices concerned | |
| <input type="checkbox"/> the International Searching Authority | <input checked="" type="checkbox"/> the elected Offices concerned | |
| <input type="checkbox"/> the International Preliminary Examining Authority | <input type="checkbox"/> other: | |

| | |
|--|--|
| <p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p> | <p>Authorized officer Margret Fourné-Godbersen</p> <p>Telephone No.: (41-22) 338.83.38</p> |
|--|--|

PCT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

| | |
|---|---|
| Date of mailing (day/month/year) 26 November 1998 (26.11.98) | |
| International application No. PCT/GB98/00866 | Applicant's or agent's file reference P53206WO |
| International filing date (day/month/year) 03 April 1998 (03.04.98) | Priority date (day/month/year) 03 April 1997 (03.04.97) |
| Applicant JONES, Barbara, Lynn et al | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

03 November 1998 (03.11.98)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|--|--|
| <p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p> | <p>Authorized officer</p> <p>G. Bähr</p> <p>Telephone No.: (41-22) 338.83.38</p> |
|--|--|

US 8901267

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 08/08/89. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

FPO FORM 10479